

Maritime Economic Interests & the Sea Lines of Communication Through the South China Sea

The Value of Trade in Southeast Asia

John H. Noer
with David Gregory

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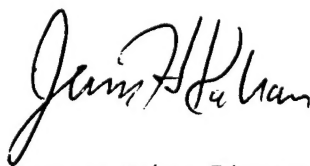
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Jerome H. Kahan, Director
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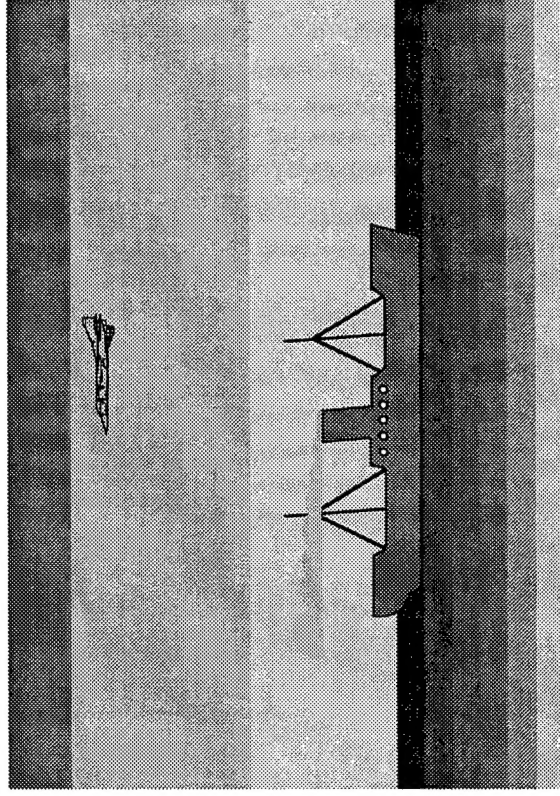
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Maritime Economic Interests & the Sea Lines of Communication Through the South China Sea

The Value of Trade in Southeast Asia



**John Noer
January 1996
Center for Naval Analyses**

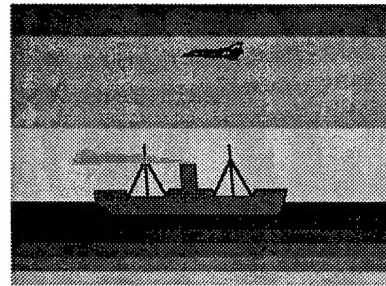
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***Maritime Economic Interests &
the Sea Lines of Communication
Through the South China Sea***



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January 1996
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The Economic and Strategic Interests of the U.S.

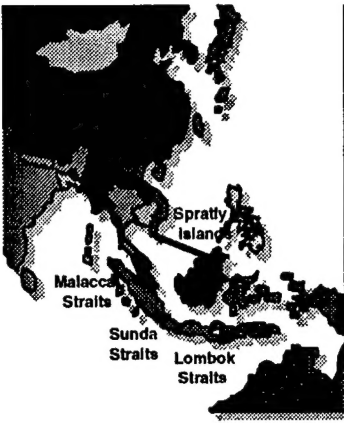
The US Navy has long been assigned the mission of helping to protect the SLOCs of Southeast Asia (SEA). During the Cold War, the mission was viewed in strategic military terms: the US needed to be able to move military supplies through the region in crises, and deny the SLOCs to the Soviets. Now that the Soviet threat has diminished, what national economic interests are at stake?

Does it matter if merchant ships are forced to detour? Whose ships and whose trade use these trade routes? What are American interests? To answer the question "Who benefits from free access to SEA SLOCs?", we gathered extensive data on shipping and trade to analyze what would happen on the high seas if these SLOCs were closed.

In early 1995, Secretary of State Christopher issued a warning to the nations quarreling over the Spratly Islands. The US does not take sides in this dispute, but will not accept the disruption of trade passing through the South China Sea. This study shows that the American position is based on direct national economic interest, as well as quasi-altruistic concern for the welfare of other nations. The United States has direct and immediate economic interests to protect in the region, as SLOC closure could immediately and directly disrupt the US economy. The US also needs to protect its trade links to healthy, prosperous trading partners to maintain its own prosperity.

South China Sea

Trade Conduit for Southeast Asia



Four strategic choke points: Straits of Malacca, Sunda & Lombok; & SLOCs passing the Spratly Islands

Study Motivation

- **SEA: rapid economic growth**
- **Malacca: vital, congested Strait**
- **Over half of the world's merchant tonnage transits South China Sea**
- **DPG=>USN:keep SEA SLOCs open**

Study Issues

- **Who would pay how much if SEA SLOCs closed to trade?**
- **What are the maritime economic interests of US, allies & others?**
- **Controversy:disagreement on facts**
- **Solution: empirical data-intensive study - facts to settle the debate**

The Straits: Chokepoints for Shipping

Many nations in Southeast Asia are either insular or peninsular, or have extended coastlines. Land transport infrastructure is not well developed. So, most trade moves by sea. The region's sea borne imports and exports are growing rapidly. Geographic and economic factors confer considerable importance to certain key waterways in Southeast Asia.

We focused on three "southern entrances" into the region: the Straits of Malacca, Sunda, and Lombok. We also focused on vessels passing by the Spratly Islands on the South China Sea.

The Policy Implications for the US

The Southeast Asian sea lanes carry nearly half of the world's merchant shipping. Large percentages of Asian trade pass through a few key Straits. Few of these shipments are American. However, the United States has long recognized that due to the importance of these Sea Lines of Communication (SLOCs) to our trading partners, stability in Southeast Asian sea lanes is important to the US. US interests in the region include: orderly shipping markets, commercial freedom of navigation, and stability on the South China Sea.

Study Approach

Maritime Economic Interests

Quantitative Study Approach

- | | |
|---|--|
| <ul style="list-style-type: none"> ■ Study Design: <i>Counterfactual Approach</i> ■ Quantitative Method: <i>Transportation Economics</i> ■ Data Output: <i>Statistics on Maritime Trade Patterns</i> ■ Analytic Output: <i>what happens if SLOCs close?</i> ■ Assumption: <i>most vessels would detour=>extra cost</i> ■ Detour Cost Analysis: <ul style="list-style-type: none"> 1) Ship Operating Costs 2) Hull Financing 3) Cargo Holding Costs | <ul style="list-style-type: none"> ■ <i>First reroute the vessels, then calculate incremental costs to shipping, then link to cargoes</i> ■ Focus: <i>direct maritime impacts, not total impact</i> ■ SLOC closures are just assumed, not explained <h4><u>Intensive Data Inputs</u></h4> <ul style="list-style-type: none"> ■ Ship file: <i>8,800+ ships in SEA SLOCs in 1993</i> ■ Voyage file: <i>95k+ in SEA origins to destinations</i> ■ Integrated Trade & Ship data <i>- what goes where on whose ship?</i> |
|---|--|

Study Method

The "counterfactual method" is a kind of sensitivity analysis. Approach: use real world data, change one key fact by assumption, and trace through the logical consequences of that "counterfactual assumption." We also made extensive use of transportation economics and cost analyses. We focused on quantitatively estimating the tangible, immediate impacts of a hypothesized SLOC closure on the shipping industry and maritime trade.

The Data

We started with a data base containing 2.2 million port calls by ships, looking for pairs of port calls which implied a voyage across the four "choke points." With the vessels identified, we accessed a vessel characteristics file of the world merchant fleet, containing data on type, owner, flag and size for over 26,000 vessels greater than 1,000 DWT. We generated nearly 90,000 voyage histories for 1993 for over 8,800 ships. This method of "derived transits" has the distinct advantage of tracing ships from origin to destination and positively identifying individual ships. We generated estimates of trade flows through the Straits, by the ship types carrying each commodity. This permitted us to link shipping patterns to trade flows. We are unaware of any other study which builds upon such a large, precise data base on individual vessel movements.

Shipping in the SEA SLOCs

1993

TONNAGE

% of World Capacity in Study Region
(353.3 Million Dead Weight Tonnes)



51%

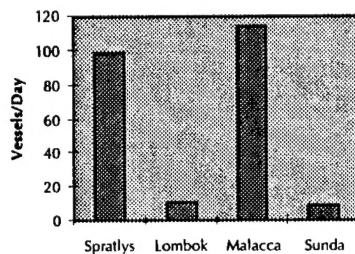
SHIPS

% of World Fleet in Study Region
(8,842 Ships)



34%

COMPARATIVE TRAFFIC LEVELS (Inter-regional Voyages Only)



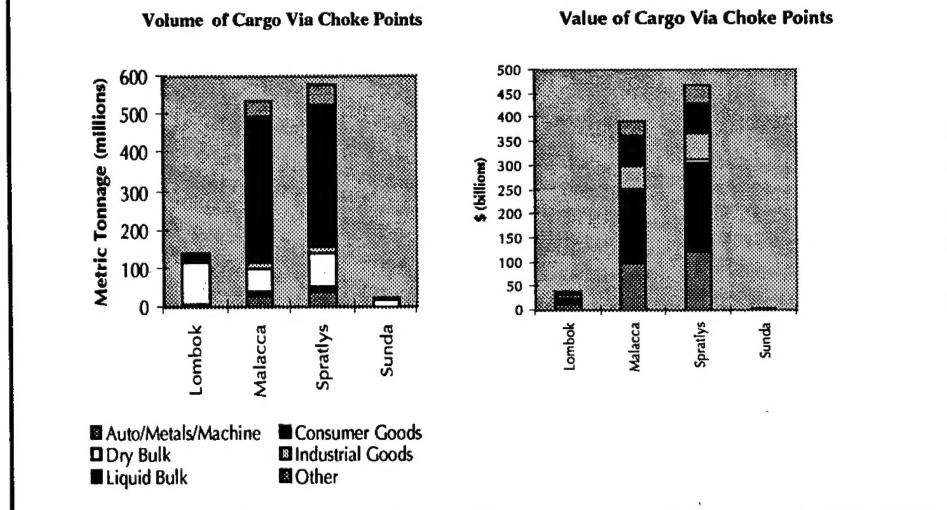
WORLD FLEET IN SEA SLOCs 1993

| Ship Type | Vessels | DWT (millions) | World Vessels (percentage) | World Capacity (percentage) |
|----------------|---------|-------------------|----------------------------------|-----------------------------------|
| Large Cellular | 230 | 10.00 | 68 | 68 |
| Small Cellular | 431 | 9.00 | 40 | 46 |
| Cargo | 2710 | 33.30 | 29 | 43 |
| Large Dry Bulk | 272 | 42.60 | 75 | 77 |
| Other Dry Bulk | 2301 | 85.00 | 52 | 55 |
| Combo | 121 | 16.60 | 35 | 48 |
| Supertankers | 297 | 77.80 | 63 | 59 |
| Tankers | 494 | 32.10 | 23 | 34 |
| Product | 912 | 29.10 | 33 | 46 |
| Special | 1094 | 17.50 | 22 | 42 |
| TOTAL | 8842 | 353.30 | 34 | 51 |

- We collected data on all merchant vessels over 1,000 deadweight tons carrying cargo on international interregional voyages in 1993 in our study region. We omit local shipping, small shipping, and non-trade activity such as fishing or passenger ships.
- These statistics describe the population of vessels which transited at least one of the four SLOCs of interest in 1993: Straits of Malacca, Sunda and Lombok; or the sea lanes passing the Spratly Islands.
- UPPER LEFT, PIE CHART - capacity in the study region
 - Over half the world's merchant capacity transited at least one of the SLOCs in 1993
- UPPER RIGHT, PIE CHART - ships in the region
 - Over a third of the world's merchant vessels transited the SLOCs
- LOWER LEFT, BAR CHART - ships through the SLOCs
 - The main southern entrance to the South China Seas is the Straits of Malacca, which carried 114 ships per day.
 - Many also pass the Spratlys.
- LOWER RIGHT, TABLE - Detail on ships by type in the region
 - The SEA SLOCs are mainly serviced by large vessels. Many of the world's supertankers, large cellular (container) ships and large dry bulk ships operate there.

Cargoes in the SEA SLOCs

Tonnage & value by commodity, 1993



- Tonnage figures are dominated by liquid & dry bulk, industrial inputs.
- Over half a billion tonnes went past the Spratlys in 1993.
- Crude oil is the biggest single cargo in volume terms.
- Lombok tonnage is dominated by Australian dry bulk - iron ore & coal.
- Value figures (in US dollars) are dominated by finished products, industrial outputs.
- Nearly half trillion dollars of cargo went past the Spratlys in 1993.

Ship Owners and Flags in the Straits of Malacca, 1993

"Top Five" Owners in Malacca

| <i>(by Capacity)</i> | | |
|-----------------------------|----------------------------|--|
| <i>Parent's Country</i> | <i>Capacity (MDWT)</i> | <i>Capacity of Fleet Flagged Out</i> |
| Japan | 432 | 62% |
| Greece | 102 | 67% |
| United States | 97 | 77% |
| Great Britain | 90 | 91% |
| Singapore | 88 | 50% |

"Top Five" Flags in Malacca

| <i>(by Capacity)</i> | | |
|----------------------------|----------------------------|---|
| <i>Vessel Registry</i> | <i>Capacity (MDWT)</i> | <i>Percent Capacity Foreign Owned</i> |
| Panama | 351 | 100% |
| Liberia | 228 | 100% |
| Japan | 176 | 7% |
| Singapore | 101 | 56% |
| Bahamas | 84 | 100% |

- **Japan owns four times the tonnage in Malacca as #2, Greece**
- **The U.S. is third in capacity owned**

- **Three of the top five flags in Malacca are "flags of convenience"**
- **The Japanese flag is flown by few foreigners**

Most vessels plying the region fly flags of convenience. The most common flag in the region is Panamanian, the second is Liberian. Japanese interests own more ships operating in the region than any other country. Most are "flagged out," so Japanese presence is discretely understated. US interests were third, behind Greece. Over three quarters of US ships in SEA flag out.

There is often little correlation between nationality of registration and nationality of owners, and these factors often have little relationship to the economies shipping or receiving cargoes. The concept of "nationality" as applied to shipping is thus ambiguous. Policies that would try to discriminate among shipping on the basis of nationality are based on faulty premises. "Nationality" is not always a meaningful concept when applied to merchant shipping.

SEA SLOCs: Crossroads for World Trade

Long Haul Maritime Trade via SEA SLOCs

| | Percent Exports | Percent Imports | Exports Billions | Imports Billions |
|-----------|--------------------|--------------------|---------------------|---------------------|
| Japan | 42.4% | 42.0% | \$153.4 | \$101.5 |
| Australia | 39.5% | 52.8% | \$16.9 | \$24.0 |
| NIEs | 25.7% | 28.3% | \$77.7 | \$84.9 |
| China | 21.8% | 10.3% | \$19.8 | \$10.6 |
| Europe | 6.8% | 10.5% | \$107.1 | \$162.0 |
| U.S.A. | 3.3% | 4.5% | \$15.2 | \$27.3 |
| S.E. Asia | 55.4% | 52.5% | \$114.3 | \$117.6 |
| All World | 15.1% | 15.2% | \$567.8 | \$567.8 |

The SEA SLOCs = Malacca, Sunda & Lombok Straits plus Spratly SLOCs.
NIEs: Hong Kong, Taiwan, & South Korea. China (PRC) trade via Hong Kong shows up as "NIE". Europe statistics excludes east european countries. Note that S.E. Asia statistics do not include intraregional or domestic trade and thus greatly understates SEA maritime trade in the SEA SLOCs. Numerator & left column: maritime inter regional trade identified in the SLOCs. Denominator: all of the nations international trade by all modes as reported by the IMF.

■ *Inter-regional maritime trade via key Straits: a measure of importance to the world economy*

■ *Inter-regional seaborne trade via SEA SLOCs is 15% of all world trade*

■ *Japan & Australia are very dependent on SEA SLOCs*

■ *Japan, Europe send huge volumes via SEA SLOCs*

■ *In general, the closer an economy is to the SLOCs the more dependent it is on them*

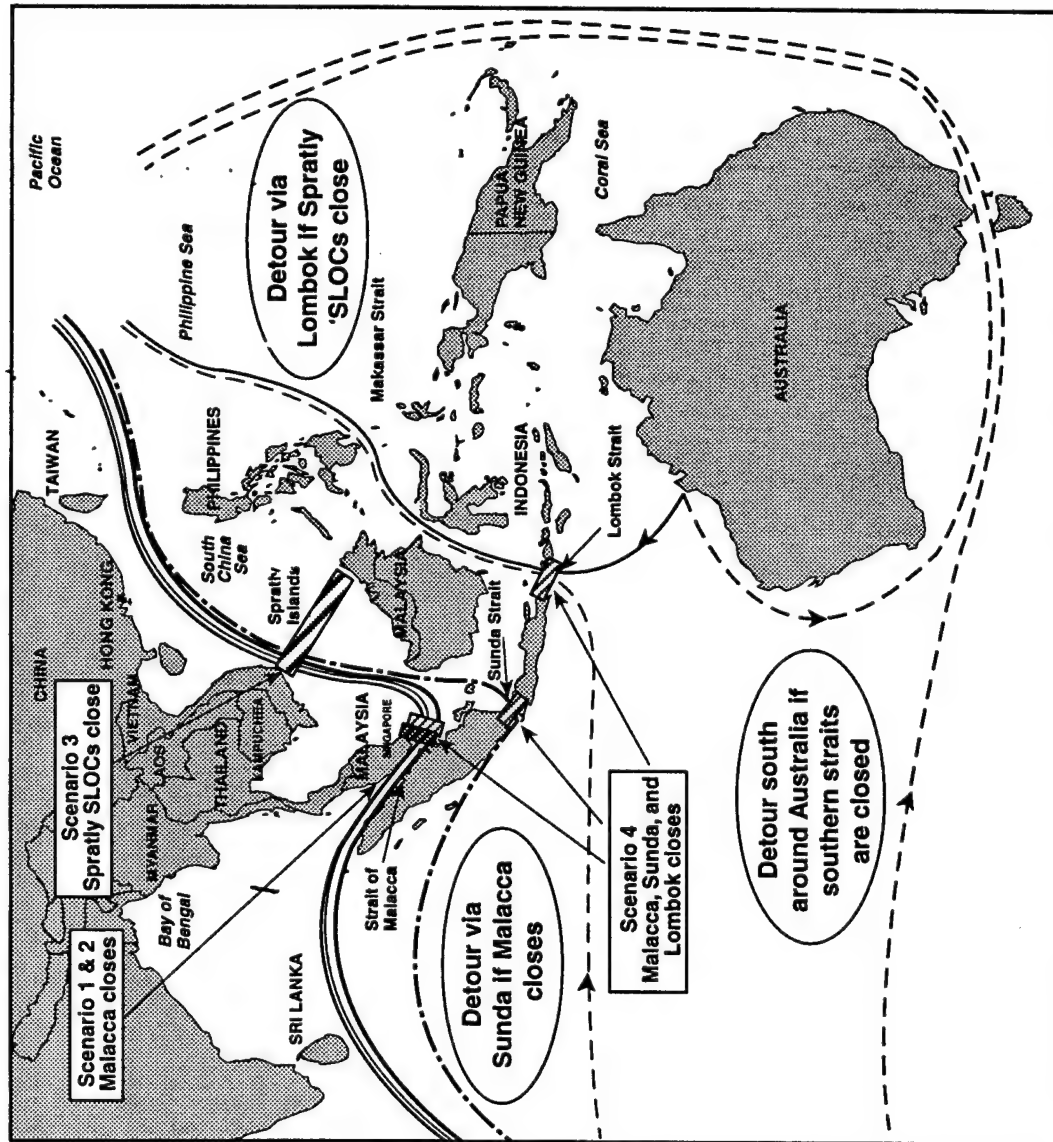
■ *China has relatively small (but growing) trade flows in the South China Sea*

Trade Through the Straits

Well over one half trillion dollars worth of long haul interregional sea borne shipments passed through these key "chokepoints" in 1993. This \$568 billion was over 15% of all the world's cross-border trade, and doesn't include trade within the region. Malacca and the Spratly SLOCs are the main routes.

Japan, Australia, and the nations of Southeast Asia send over 40% of their trade by sea through these chokepoints. Their economic vitality clearly depends on free access to these sea lanes. American prosperity in turn relies on the economic health of our trade partners.

Scenario SLOC Blockages and Alternate Routes



Scenarios

Trade interruptions vs SLOC closure

The Scenarios

- **1. Malacca Straits closed**
 - ... Reroute via Sunda
 - ... Detours only, no trade stopped
- **2. Malacca closed, port of Singapore blocked**
 - ... Detours and trade interruption
- **3. Spratly SLOCs closed**
 - ... Reroute via Lombok-Makassar
 - ... Detours only, no trade interruption.
- **4. Malacca, Sunda and Lombok Straits closed**
 - ... Reroute south of Australia
 - ... Many SEA ports also blocked

SLOC Closure vs Port Blockage

- **SLOC closures increase demand for shipping**
 - ... Same cargoes steam farther
 - ... More ton-miles required
 - ... Cost: extra shipping
- **Trade interruptions (port blockages) reduce the demand for shipping**
 - ... Trade drives demand for ships
 - ... Less trade => less ton-miles demanded
 - ... Cost not estimated in this study: loss of "value added" of lost trade
- **#1, #3 are "pure detour"**
 - ... Demand increases
- **#2, #4 are "mixed"**
 - ... Increased demand due to detours offset by demand reduction due to lost trade

The previous few slides have given the base case: real-world data for 1993. We now change one key fact (for each scenario) - SLOC closure and/or port blockage - and trace through the consequences of that "counterfactual" assumption.

We look at three economic consequences for these four scenarios: the short-run impact of diversion (SLOC closed), the long-run impact of diversion, and the impact of port blockage.

Short Run Impact: Freight Rates Up

Capacity demanded absorbs excess supply

Global Capacity versus Demand Impact

| | Normal Excess Capacity 1990-94 | —Extra Demand— Malacca Straits Closed | Spratly SLOCs Closed |
|-----------|---|--|----------------------------|
| Shiptype | | | |
| Cellular | 24.3% | 11.7% | 23.6% |
| Liner | 19.8% | 13.0% | 23.8% |
| Dry Bulk | 14.3% | 8.8% | 16.5% |
| Tankers | 13.7% | 13.7% | 23.3% |
| All Ships | 15.4% | 11.8% | 21.2% |

■ Short Run: Rates Equate Demand to Available Capacity

- ... Longer voyages => more ton-mile demand. Impacts world market?
- ... Short run: rates determined by supply-demand balance, not costs
- ... Finding: increase is significant

■ Close Malacca: Rates Up

- ... Most of usual bulk capacity overhang absorbed

■ Close Spratly SLOCs: World Rates Up Even More. Big shock

- ... All unused capacity used up
- ... Some bulk cargoes won't move

■ Strongest Impact: Bulk Cargoes

- ... Smaller excess capacity available
- ... Higher transport costs affect low value cargoes more

World shipping markets directly link Southeast Asian sea lanes to the US economy. If events threatened trade in the South China Sea, ships could simply detour. Ships would travel farther to deliver their cargoes, albeit at higher cost, raising demand for global shipping capacity. If the disturbance happens on the South China Sea, freight rates could rise dramatically worldwide, due to the concentration of world shipping there. Shippers on the east and west coasts of the US would be forced to pay higher shipping rates, or lose service.

Nearly half the world fleet would be required to sail farther, increasing demand for vessel capacity. All excess capacity of the world fleet might be absorbed. The effect would be strongest for crude oil shipments and dry bulk such as iron ore and coal. Closure of the Straits of Malacca would immediately raise freight rates. Denial of the SLOCs passing the Spratly Islands to merchant shipping would disrupt world shipping markets even more severely. Freight rates around the world would be affected, thus adding costs to American imports and exports. All trading nations have a vested interest in preserving stability on the SEA SLOCs.

Note that military or physical SLOC closure is not required. Suppose war-related uncertainty over the Spratlys caused maritime insurers to either increase rates or deny coverage in the region. Shippers might be motivated to reroute shipping via safer sea lanes. The factor that converts a localized maritime concern (SLOC blockage) to a global economic event (freight rate crisis cum capacity shortfall) is the large volume of shipping involved on the South China Sea.

Long Run Impact Closed SLOCs Increase Costs

DETOUR COSTS TO SHIPPING BY SCENARIO

Total increased voyage costs,
& costs as a percent of cargo value

| Closed SLOCs | Detour Costs* | "Average Tax Equivalent" |
|---------------------------------------|------------------|-----------------------------|
| - Malacca Straits | \$1.3 Bil. | 0.3% |
| - Spratly SLOCs | \$3.1 Bil. | 0.7% |
| - Malacca, Sunda, & Lombok Straits | \$7.4 Bil. | 2.2% |

* annualized

*Note: last scenario assumes some ports & cargoes are blocked.
Trade interruptions generate economic losses but no "detour costs".
Right column is total extra steaming costs, divided by value of
cargoes diverted. Corresponds to Scenario 1, 3 and 4. Costs
include: vessel operating costs (including crews and fuel); the
incremental cost of capital for financing the ship, and the
inventory costs of holding cargoes on longer voyages.*

■ Long Run Impact: Freight Rates are determined by costs

- ... Longer voyages = > higher costs
- ... Fleet size adjusts to demand
- ... Route specific, not global

■ Large costs to shipping: \$3.6 (Malacca closed) to \$20.3 million (around Australia) per day

■ Can be analyzed as a "tax"

- ... Large costs spread over huge
volumes of cargo
- ... Small "average tax"

■ The lower the cargo value, the greater the closure impact

- ... Shipping costs are per ton
- ... Impact is "ad valorem"

In principle, closure of shipping lanes might not be a serious matter. Alternate routes are usually available. For example, ships denied access to the Malacca Straits might use Sunda. The Straits of Lombok and Makassar offer an alternative to the South China Seas. These detours are not so large, and after all, merchant vessels offer one of the cheapest modes of transport.

In the long run, if the merchant maritime transport market fully adjusted to a closed SEA SLOC, the extra sailing costs of the detours would indeed be insignificant. In most cases, only a few cents on the dollar would be added to the landed price of most goods. It is difficult, however, to suppose that adjusting to a disruption of the type hypothesized would be easy.

In practice, however, it turns out that closure of these particular SLOCs would matter a great deal due to the disruption of the balance of supply and demand for merchant shipping. It's a fleet capacity issue, not a steaming cost issue.

Long Run Impact of Detours

Selected Cargoes by Route

| CARGO | ROUTE | Detour Cost | As % Value |
|---|-------------------|---------------|------------|
| MALACCA CLOSED | | | |
| Iron Ore | India - Japan | \$16.2 mil | 4.0% |
| Crude Oil | Arab Gulf - Japan | \$54.2 mil | 0.7% |
| Elec.Eq. | Japan-N. Europe | \$17/21 mil | 0.1% |
| SPRATLY SLOCs CLOSED | | | |
| Iron Ore | India - Japan | \$22.6 mil | 5.5% |
| Crude Oil | Arab Gulf - Japan | \$192.3 mil | 0.9% |
| Elec.Eq. | Japan-N. Europe | \$28/36 mil | 0.2% |
| MALACCA, SUNDA & LOMBOK CLOSED | | | |
| Iron Ore | Australia - Japan | \$72.8 mil | 24.4% |
| Crude Oil | Arab Gulf - Japan | \$1.2 bil | 5.6% |
| Gas | Arab Gulf - Japan | \$322.7 mil | 12.7% |
| Elec.Eq. | Japan - N. Europe | \$112-141 mil | 0.6% |

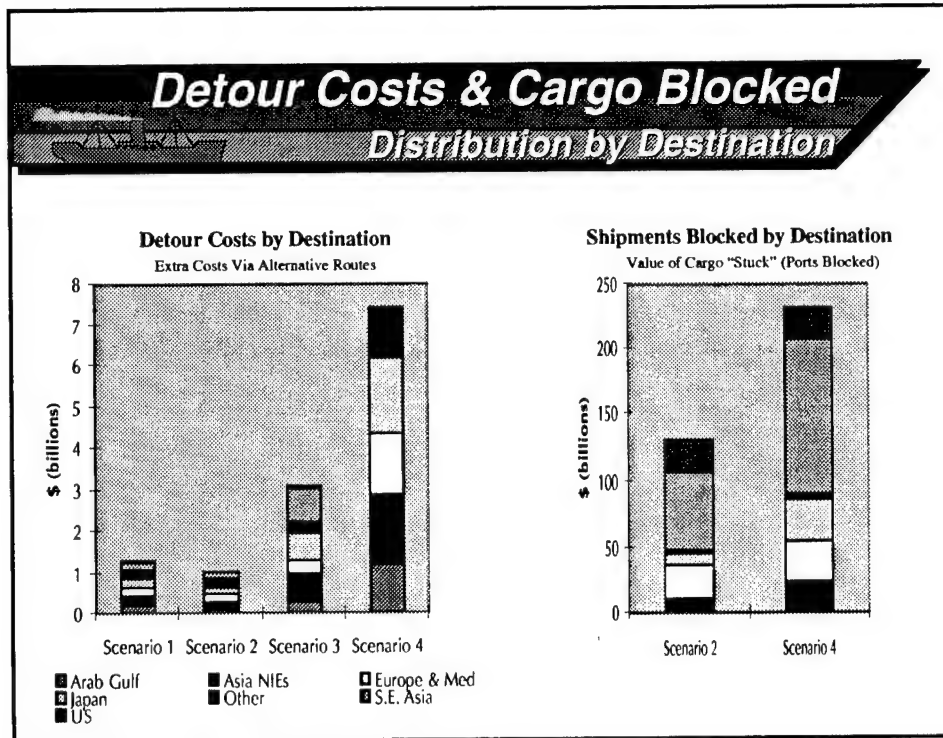
Detour costs include incremental vessel operating costs and financing for hulls & cargo holding costs, due to longer voyages. Costs are reported on an annual basis, and are specific to commodities by route. Bulk cargoes are costed round trip, including ballast leg. Range given for finished goods by liner or container.

- The long run "tax-like" cost impact varies greatly by scenario, route & cargo
- Some routes, cargoes are hard hit.... shipping patterns would change for some commodities
- Crude oil would cost \$3.3 million per day more to ship from Arab Gulf to Japan if SEA SLOCs were closed
- Strongest Impact on Bulk
 - ... Higher transport costs affect low value cargoes more
 - ... Some bulk cargoes could be priced out of the market by extended closures

Bulk cargoes are generally much more vulnerable to the extra steaming costs due to vessel detours. Since they are typically much lower in value than finished goods on a per-ton basis, a few extra dollars of shipping cost can make a big difference. Commodities also typically compete on the basis of price, so a few dollars of price difference might cause a major reordering of the world trade patterns in certain commodities. Also, there is simply less excess capacity in the bulk carrier fleet than there is in the container and liner trades. So the short run impact would hit hard, and adjustment of the merchant marine fleet would take longer.

Above we show "tax equivalence" calculations for selected trade routes for some typical cargoes:

- iron ore, the cheapest commodity per ton sailing the high seas;
- crude oil, the commodity most often found on the high seas; and
- electrical equipment, one of the more valuable cargoes per ton.



LEFT-HAND CHART: Extra Shipping Costs by Scenario

This chart shows the distribution by destination of annualized costs due purely to detours and longer voyages. The cost elements are: extra vessel operating costs, extra holding costs for cargo in transit, and extra cost of capital for vessels. On a daily basis, that is \$3.5 to \$20 million per day.

RIGHT-HAND CHART: Value of Blocked Trade

Finally, having examined the short-term and long-term impacts of detours, we address the magnitude of blocked trade. Two of our scenarios assume port blockages which prevent shipments from moving. This chart gives the distribution of blocked trade by destination.

Note two features: blocked shipments, on the right, are very large compared to detour costs; and their impact is very concentrated on the Southeast Asian nations near the SLOCs.

Results

- **Short term: closed SEA SLOCs would generate a large jump in world maritime freight rates. Trade from American ports would be adversely affected**
 - The United States has an interest in orderly shipping in SEA
- **Long term closures: big impact on bulk cargoes**
 - Australia is particularly vulnerable to SEA SLOC disruptions
- **Countries nearest SLOCs would be hardest hit**
 - =>Stability factor. They are best able to defend or close SLOCs
- **SLOC closures which force detours warrant attention**
 - Actual costs may not be *causus belli* per se
 - But they indicate markets are apprehensive of worse to come
- **Trade interruptions (blocked ports) are much worse than detours on the high seas**

Study Results

Closure of Malacca or the Spratly SLOCs would generate a large increase in freight rates worldwide due to the heavy concentration of world shipping there. This fact was not intuitively obvious to us *ex ante*. Bulk shipments would be hardest hit.

The trade pattern via the chokepoints is dominated by a flow of high-volume raw materials north and east, and high-value finished goods returning south and west. Japan has the largest volume of interregional trade and shipping through the SEA SLOCs. Much of Japan's traffic could easily reroute in a crisis. Australia is heavily dependent upon the Straits of Lombok. Most interregional trade there is Australian.

Economic interests and geography, on balance, should work to keep open strategic straits. Countries adjacent to straits are the states most able to close them for geographic reasons, but also are best able to defend them. Their economic interests are to keep the straits open. It is in the interest of the world (and the United States) to vigorously assert the right of freedom of navigation on international waterways.

Interpretations

- **Post-Cold War economic-based interests are more complex, less obvious than during the East-West confrontation**
 - ... *Economic interests vary from nation to nation*
 - ... *Politically different nations can have mutual interests*
 - ... *Multi-polarization => can yield international consensus*
- **FON has both economic & strategic significance**
 - ... *Freedom of maritime shipping is required for free trade*
- **Naval SLOC protection mission has merit in it's own right**
 - ... *Economic benefits - not just a military "enabling mission"*
- **US maritime interests in SEA are significant**
 - ... *US directly linked to SEA shipping via transport markets*
 - ... *Trade links are largely indirect, via trade partners*
 - => *implies Division of Labor - partners motivated to help*

Interpretations

"Threat analysis" no longer answers the questions of force size and mix now that the Cold War is over. We no longer face a bipolar world of stable ideology-based alliances. We need to know our own national interests and those of other nations, if we are to deploy our forces to best advantage.

The concept of "Freedom of Navigation" has both economic and strategic significance. Naval sea lane protection is a mission with economic merit in its own right. Forward presence yields benefits in terms of US national interests via the component missions, which include protection of shipping and trade.

The US has immediate and direct maritime interests in stability in the South China Sea SLOCs, as disruptions there would be transmitted to the US economy. This is true even if most of the trade there does not come from or go to the United States. However, the nations in SEA would be affected more directly by such disruptions. These nations have more at stake in the free movement of shipping on SEA SLOCs than does the US. These nations should be natural allies, motivated to cooperate, and to share the costs of naval SLOC protection. Commercial FON in the SLOCs should be a rallying issue for international cooperation and consensus.



Appendix & Backup Slides

- ***Traffic in the Malacca Straits & Spratly SLOCs by vessel type, 1993***
- ***Japanese ships & the Panamanian flag in Malacca, 1993***
- ***VLCCs in the Malacca Straits***
- ***Interregional trade by origin & destination, 1993***
- ***Economic Model of the Short Run***
 - ... *Freight rates determined by capacity & demand*
- ***Long Run Impact of Closed SLOCs***
- ***Straits of Lombok & Makassar***
 - ... *Preferred Alternative to the South China Sea*

This appendix provides additional data on shipping in the region. Also presented are the economic models used to generate the economic impact analysis reported in the main body of the brief. The main section is intended as a "flag-level brief"; the detail in this appendix combines to give a longer "staff brief".

Malacca & Spratlys Shipping

By vessel type & direction, 1993

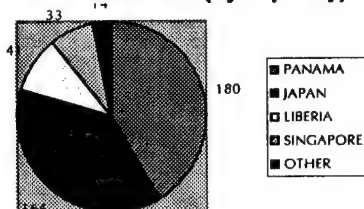
| Eastbound | MALACCA STRAITS | | SPRATLY IS. SLOCs | |
|---------------------------------------|-----------------|----------|-------------------|----------|
| | Voyages | Mil. DWT | Voyages | Mil. DWT |
| VLCCs (Crude >160K DWT) | 1,122 | 286 | 931 | 234 |
| Tankers (Crude <160K DWT) | 1,895 | 80 | 830 | 56 |
| Large Bulk (> 100K DWT) | 130 | 19 | 325 | 49 |
| Bulk (< 100K DWT) | 2,589 | 88 | 2,004 | 70 |
| Product (petroleum & chemical) | 2,514 | 74 | 2,028 | 76 |
| Combo (wet & dry bulk) | 82 | 10 | 118 | 17 |
| Cellular (container) | 3,611 | 86 | 3,330 | 94 |
| General Cargo | 6,174 | 65 | 5,257 | 57 |
| Special* | 2,801 | 64 | 2,621 | 76 |
| Total Eastbound | 20,918 | 773 | 17,444 | 729 |
| Total Westbound | 20,591 | 793 | 18,583 | 756 |
| Total Transits | 41,509 | 1,566 | 36,027 | 1,485 |

Note: Includes only merchant vessels greater than 1,000 DWT on international voyages. Does not include smaller vessels, fishing boats, ferries, warships, or local/domestic trade. **Special* includes Ro/Ro, gas tankers, reefer, vehicle carriers & "others". *Malacca transit* means between the Indian Ocean & Singapore.

This table provides detail by vessel type of the individual ships identified as passing through key study SLOCs in 1993. About 1.5 billion deadweight tons of shipping capacity passed through these main routes. Tankers provided the largest capacity throughput; cellular & general cargo vessels generated the most movements.

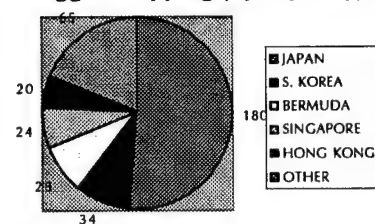
Japanese Ships & the Panama Flag in Malacca -1993

Flags flown by Japanese owned vessels (by capacity)



- **Japan owns by far the most tonnage passing through Malacca**
- **Most Japanese owned vessels fly flags of convenience**

Owners of Panamanian flagged shipping (by capacity)



- **The Panamanian flag is the most common flag in the Straits of Malacca**
- **Most of these vessels are owned by Asian interests**

- Most Japanese-owned tonnage which sailed through the Straits of Malacca in 1993 flew a flag of convenience. Only 38% of this Japanese-owned tonnage flew the Japanese flag.
- Of the "top five" nations in terms of ownership of tonnage throughput in Malacca, all flagged out half or more of their capacity.
- Over half of Panamanian flagged tonnage was Japanese owned; most of the rest was owned by other Asians.

Supertankers in Malacca

Safety vs FON in the Straits

SUPERTANKERS IN THE STRAITS OF MALACCA, 1993

| | | |
|---------------------------------------|----------|---------------|
| VLCC Size (DWT): | 160-250K | > 250K |
| Average Draft (meters) | 19.4 | 21.2 m |
| Draft Standard Deviation | 1.0 | 1.4 m |
| Depth in Malacca Straits | 21.1- | 22.9 m |
| Desired Keel Clearance | 1.0- | 3.5 m |
| <i>Transits Eastbound-Laden VLCCs</i> | | |
| Supertankers Passing | 452 | 669 ships |
| Deadweight Tons (DWT) | 105.6 | 179.8 mil. dt |
| <i>Crude Oil Cargoes Eastbound</i> | | |
| Millions of Tons | 102.6 | 168.6 mt |
| Value (\$Billions) | \$13.6 | \$21.7 |
| <i>Distribution by Trade Route</i> | | |
| Arab Gulf to Japan | 24.8% | 30.0% |
| Arab Gulf to NIEs* | 8.0% | 14.9% |
| Arab Gulf to Singapore | 4.8% | 17.0% |
| Other Oil by VLCC | 0.3% | 0.3% |

* NIE = Hong Kong, Taiwan, & South Korea

- **Few VLCCs via Lombok-Makassar**
- **Malacca VLCCs test the draft limit**
- **1100+ laden VLCCs pass carrying 1/4 billion tons of oil, \$35+ billion**
- **Most oil moves to north Asia**
 - ... but the international Straits are in Malaysian & Indonesian waters
- **Dense ship traffic in Malacca**
 - ... 113+ inter regional large ships daily
 - ... narrow channel - collisions occur
- **Are the Malacca Straits "an accident waiting to happen?"**
- **Malaysia wants VTS guidance**
 - ... proposed Vessel Traffic System (VTS)
 - ... like English Channel.. but "control"?
 - ... may conduct vessel traffic counts....

The Straits of Malacca

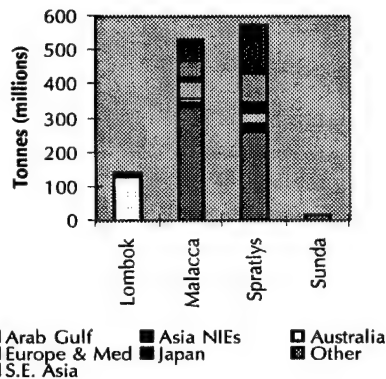
Our findings support concern for maritime safety in the crowded, shallow, and narrow Straits of Malacca. We identified 114 large merchant vessels per day on interregional voyages in the Malacca Straits in 1993. Local and other shipping increases the total.

Indonesia and Malaysia prefer that deep-draft supertankers use the deeper and less crowded Straits of Lombok and Makassar. We found that they do not. Over 1,100 fully laden supertankers annually pass eastbound through the Straits, many with only a meter or two of clearance between their keels and the channel bottom. Most go to Japan or north Asia, while about 20% are going to Singapore.

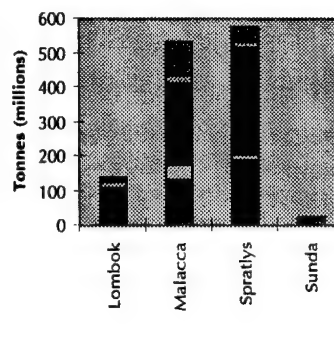
Indonesia and Malaysia have coastlines and fisheries that could suffer in the event of an oil spill or similar disaster. In contrast, Singapore has little environment at risk, is highly dependent upon international shipping through the Straits, and now hosts the world's largest oil refinery. Singapore has very different national interests at stake in the Straits of Malacca than her neighbors.

Volume of Trade in SEA SLOCs by Origin & Destination, 1993

Origins of Cargo Via Choke Points



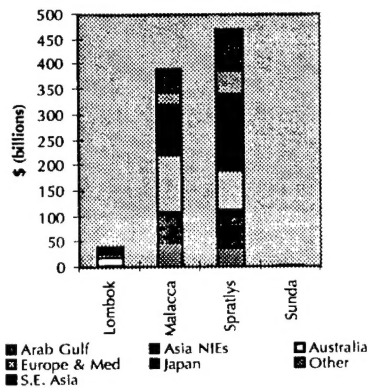
Destinations of Cargo Via Choke Points



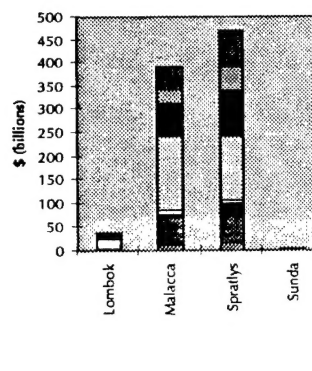
- Tonnages are dominated by raw materials going east and north to industrial north Asia.
- Nearly two thirds of the tonnage passing Malacca, and half the volume passing the Spratlys, is crude oil from the Arab Gulf. Cargoes from Southeast Asia itself are second.
- Australian-origin dry bulk accounts for most of the tonnage in Lombok.
- The main destination: Japan. The "Newly Industrialized Economies" of South Korea, Taiwan and Hong Kong are second.
- The pattern: large tonnages of low-value bulk commodities are shipped to industrialized nations, which "add value" via manufacturing processes; and then ship out relatively smaller tonnages of high-value goods.

Value of Trade in SEA SLOCs by Origin & Destination, 1993

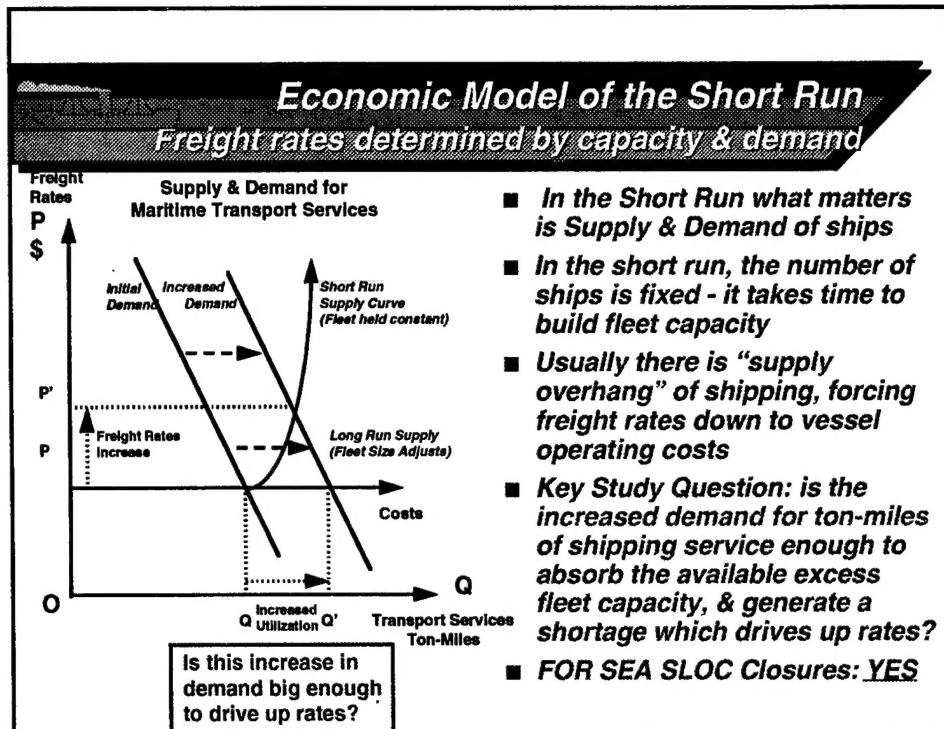
Origins of Cargo Via Choke Points



Destinations of Cargo Via Choke Points



- Japan ships most of the cargo by value past the Spratlys. Europe and the other Asian economies are also big players.
- The biggest single destination is Europe, which is half way around the world, mainly receiving Japanese goods. Japan is the second biggest destination.
- Note that tonnage statistics, from the last slide, are dominated by bulk. The bulk shipments are "one-way". In contrast, the finished goods shipments which dominate the value statistics are "two-way" in nature.

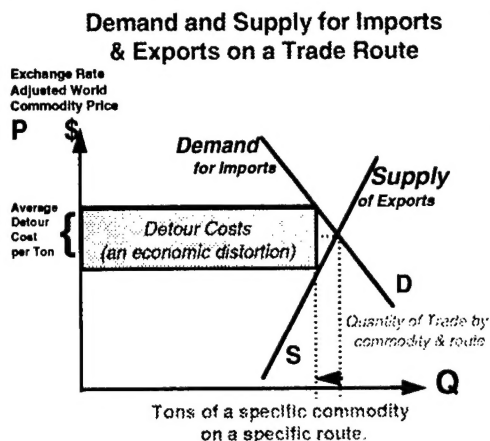


The Model. Freight Rates are the "Price" of maritime transport, vessel operating costs are the main "production cost", and ton-miles of cargo moved is a measurement of "Quantity" supplied in the market. In the short run, supply is "inelastic" or "rigid" because only commissioned vessels are available. Demand is generally price inelastic (or "insensitive"). The combination of inelastic supply and demand makes freight rates very volatile over a wide range in the short run. What matters is the balance of available supply versus desired demand worldwide. This is a global market. Usually rates are just enough to cover costs, but rates can soar very high under pressure.

Fleet Operating Tempo. Merchants generally operate at "slow service speed" to save costs when rates are low (the usual case). When rates are high they steam faster, turnaround in port quicker, and load fully. At this higher operating tempo, the fleet generates more ton-miles of service with the same number of ships. Of course, vessel operating costs are much higher - but higher rates ensure profits.

The Impact of SLOC Closures. Suppose shipping is motivated - perhaps by apprehension - to avoid the shortest course between two major markets. The detour requires vessels to sail farther in order to deliver the same cargoes, increasing the ton-miles demanded. Normally there is some excess shipping available to the market, often older vessels. The quantitative question is whether the extra capacity requirement is enough to absorb all the excess available capacity, and put upward pressure on freight rates. If so, rates will go up worldwide.

Long Run Impact of Closed SLOCs



**"Tax Equivalence" = Detour costs
divided by the value of the cargo**

- **In the long run, the fleet size adjusts. Supply = demand. Costs determine freight rates**
- **If SLOC closure persists - it impacts only those trade routes through the SLOC**
- **Longer voyages = higher cost**
 - ... more fuel, more crew wages
 - ... more capacity must be financed
 - ... cargoes held in transit longer
- **Producers and consumers must pay extra shipping costs**
- **Detour costs are like a "tax"**
 - ... separates price received by exporter from price paid by importer - but no government receives the revenue

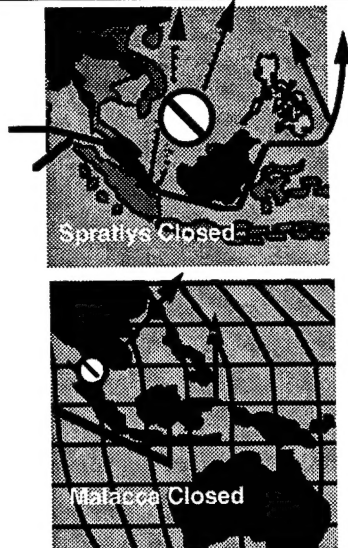
Shipping markets are very competitive. The increase in freight rates caused by a capacity shortage will eventually be offset as vessel owners add capacity to the fleet in pursuit of profits. In the long run, supply is very elastic, as with time any number of vessels can be added to the world fleet. After the fleet capacity adjusts, freight rates will again be determined by costs. Only ships sailing longer routes around closed SLOCs will then be affected.

The extra detour costs will act like a "tax", driving a wedge-like distortion between suppliers and demanders of the cargoes being shipped. Whether exporters or importers pay the "tax" (or share it) depends upon market conditions.

This tax-like effect is likely to be small in our scenarios compared with the affect of a freight rate distortion. Note that the added shipping-cost effect compounds any impact on freight rates, and both effects kick in immediately. The shipping cost effect, which is local to the trade route, lasts as long as the detour is in effect. The freight rate effect depends on supply & demand of ships, and is global, impacting shipping markets worldwide.

Straits of Lombok & Makassar

Preferred Alternative to the South China Sea



- **FON for merchants in the South China Sea (SCS) is clearly a priority**
- **If SCS SLOCs close, the economic benefits of keeping open Lombok-Makassar (L-M) are large - avoid detour south around Australia**
- **But - events closing SCS SLOCs might spill over to L-M without naval containment**
- **Naval Mission: L-M SLOC protection**
 - **convoy exercises can be low - profile, benign - suitable for loose coalitions with developing navies**
- **Opportunity: Regional consensus?**
 - **it's in the interests of *all* players to keep open the L-M option**
 - **less complex than SCS**

The most important routes to protect are through Malacca and past the Spratlys. However, if troubles occur in the South China Sea, the Lombok-Makassar route might turn out to be the preferred alternative. Should world events lead merchant shipping to be wary of the main routes via Malacca and by the Spratly Islands, the availability of alternate routes (via the Straits of Lombok and Makassar) could greatly mitigate the negative impacts to the world economy.

Perhaps cooperating navies could practice escorting vessels along the routes, protecting international shipping and the sea lanes. Practical considerations, such as interoperability issues and geographic areas of responsibility could be worked out, creating a real multinational naval capability that would be available should disruption occur. Actually escorting and passing off groups of cooperating merchant ships could add realism to the exercise.

Note that the high traffic levels probably render convoying impractical under many circumstances. In only a few days, fleets of hundreds of merchant could assemble, with considerable delay and expense, to be guarded by a handful of escorts. Other methods of shipping and SLOC protection are probably better. But, naval exercises focused on SLOC protection could help generate a regional consensus. All trading nations in the area have a vested interest in stability on the sea lanes.